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INSTRUCTION MANUAL

MODEL 2283

Integrated Circuit Noise Analyzer Control Unit

For Serial No. 1017

Quan-Tech
DIVISION OF STANSBURY INDUSTRIES, INC.

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Block Diagram and Schematics at Rear of Manual

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A. DESCRIPTION

The Quan-Tech Model 2283 Integrated Circuit Noise Analyzer Control Unit provides the means for applying the operating voltages and the noise monitoring circuitry for measuring the noise parameters of practically any low voltage device. The test socket and associated circuit components are mounted on a plug-in printed circuit board which inherently provides for custom designed front end configurations.

The Model 2283 is manually calibrated through the use of an internal 1 KHz calibrate oscillator and adjustable amplifier gain. Normally the plug-in test board is designed as a feedback amplifier to eliminate the need to calibrate each individual device of the same type.

When used with an appropriate filter unit such as the Quan-Tech Model 2181, noise measurements can be made over the maximum frequency range of from 10 Hz to 100 KHz.

B. SPECIFICATIONS

Supply Voltages	0 to +30 volts, variable, switched on/off by jig door interlock, metered in two ranges, 10 and 30 volts full scale.
	0 to −30 volts, variable, switched on/off by jig door interlock, metered in two ranges, 10 and 30 volts full scale.
	+12 volts, fixed, not switched or metered.
	−12 volts, fixed, not switched or metered.
Supply Current	100 milliamperes maximum from each supply.
Frequency Response	5 Hz to 125 KHz or 500 Hz to 125 KHz, selected by front panel switch.
Component Test Circuit	A plug-in test circuit board is supplied for the 709 integrated circuit. Two blank test boards are also included to permit the user to make up special test circuits.
System Gain	When properly calibrated the overall gain from the input of the circuit (component) under test to the BNC output connector at the rear of the Model 2283 is 10,000.
System Noise	Referred to the front end through a unity gain test circuit the system noise is approximately 10 nanovolts per root cycle at 1 KHz and 75 nanovolts per root cycle at 10 Hz. In practice these values will be reduced by the voltage gain of the test board which is normally ten to one or greater.
Power Input	117/234 volts, 60 Hz.
Dimensions	5¼" x 19" standard rack panel, 16" deep overall.
Weight	2283 w/o case – 20 lbs. 2283 with 5¼" case – 31 lbs. 2283/2181 w/o case – 40 lbs. 2283/2181 with 10½" case – 54 lbs.

C. ACCESSORIES

1. One type 1113 Cable (BNC to BNC) to connect the output of the Model 2283 to the input of the Filter Unit, such as Model 2181.
2. One type 709 IC Test Board Assembly 5918.
3. Two Type 6287 Blank Test Boards.

A. FIRST TIME OPERATION

The procedure given below will enable an operator to energize the equipment, and through the use of an appropriate filter unit and test board, make a noise test on an integrated circuit. If there is a question concerning either proper operation or calibration, the procedure headed NORMAL OPERATION in Section 5 should be followed.

1. Plug the line cord of the Filter Unit into the line receptacle provided at the rear of the Control Unit.

2. Connect the noise output of the Control Unit to the noise input of the Filter Unit, using the Type 1113 cable provided.

3. Plug the line cord of the Control Unit into a suitable supply of 117v, 60 Hz line power and turn the power switch to ON.

4. Set the Control Unit front panel controls as follows:
   a) Insert the appropriate test board into the test fixture, move the test board and guide assembly to the slanting position and engage the retaining thumb screws. Close the shield cover without an I.C. in the test socket.

   b) TEST–CAL switch in the CAL position.

   c) TEST FREQ switch in the $\geq$10 Hz position.

   d) IC CIRCUIT GAIN switch in the approximate position of the gain of the test board.

   e) NEG. VOLTS range switch to the appropriate range and adjust the small concentric knob for the correct voltage.

   f) POS. VOLTS range switch and concentric control knob for the correct voltage.
      NOTE: The front panel voltage meters read the actual voltage on the test board; since these voltages are reduced to less than 1 volt by the interlock switch, the shield cover must be closed to set up proper voltages.

5. Set the Filter Unit attenuator and multipliers to the fully clockwise positions.

6. Insert the integrated circuit to be tested and close the shield cover.

   WARNING! Never insert an IC into the test socket when the interlock button is depressed as damage to the device may result.

7. Adjust the small concentric knob on the IC CIRCUIT GAIN switch for center scale indication on the CALIBRATE meter.

8. Switch the TEST–CAL switch to the TEST position.

9. Set the NOISE VOLTAGE F.S. switch and the SCALE MULTIPLIERS on the Filter Unit for on scale meter indications. The noise meters are now indicating the noise voltage spectral densities at each of the indicated frequencies. (Noise voltage referred to a one Hz bandwidth and to the input of the device under test).

B. FRONT PANEL METERS AND CONTROLS

1. Test Board Cover

   The very low measuring levels of the equipment require that the circuitry be shielded when a noise measurement is being made. The hinged cover accomplishes the required shielding and also activates an interlock switch which removes the variable voltages from the test socket for loading and unloading. This cover should be closed when a noise measurement is being made.

2. Plug-in Test Boards.

   The test board included as a standard accessory is provided both because of the popularity of the 709 integrated circuit, and to serve as an example of the type circuitry required for making noise measurements. Two blank test boards are also included to provide a start for the user in making up special test boards.

   The plug-in feature of the test board, bias supplies available and internal calibration capability with 50DB gain range provide almost unlimited versatility in the types of devices that can be tested.

   Although the Model 2283 can be calibrated with a test board voltage gain of unity, it is recommended that the board be designed for an overall voltage gain of at least 10. The higher voltage gain in the test board reduces the effective system noise of the Model 2283.

Following is a description of the test socket connections which will be required for the design of the test board. (Numbering is from right to left as viewed from the front of the Model 2283).

Pin 1: Remote interlock - grounding this pin activates the interlock function which could be required at a remote test fixture.

Pin 2: Chassis ground.

Pin 3: Positive 0–30v variable power supply. Available for circuit biasing up to 100 ma load. Reduced to less than one volt when interlock is activated.

Pin 4: No connection.

Pin 5: Calibrate signal input to test board. One ohm source.

Pin 6: Negative 0–30v variable power supply. Same as positive supply; 100 ma load capability and also reduced to less than one volt when shield cover is open.

Pin 7: Signal output of the test board which corresponds to the noise input of the Model 2283.

Pin 8: Positive 12v fixed power supply having a 100 ma load capability which is not interrupted by the shield interlock.

Pin 9: Negative 12v fixed power supply same as above.

Pin 10: No connection.

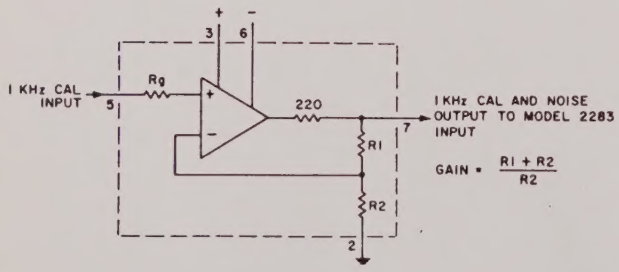


Figure 2 – 1 Simplified Test Board Schematic

Figure 2-1 shows a typical circuit for a high gain operational amplifier in which negative feedback is employed to achieve a stabilized voltage gain of 10.

Certain other components are usually required on a test board such as the recommended frequency compensation networks.

It should be noted that resistor R2 enters into the noise measurement as if it were Rg. In other words a true value of source resistance is Rg + R2.

3. TEST–CAL Switch

This two position toggle switch controls the bias voltages for the calibrate oscillator and CALIBRATE meter amplifier (Assembly 5915). In the CAL position the voltages are applied to this assembly and the calibrate function can be performed.

4. EXT. CAL Jack

The EXT. CAL jack provides the means for applying an external signal, either white noise or sine wave to check calibration. When a phone plug is inserted all the way into the EXT. CAL jack the internal 1 KHz calibrate signal is disconnected and the CALIBRATE meter remains operable. The input resistance at this jack is 600 ohms and there is a signal attenuation of 1000:1 to the input of the device under test. (The apparent gain from EXT. CAL input to the NOISE OUT jack, J302, is therefore 10:1).

5. TEST FREQUENCY

The low frequency roll-off is selected with this switch. In the 10 Hz position the roll-off frequency is slightly below 10 Hz to permit 10 Hz measurements to be made when using a Model 2181 Filter Unit. In the 1 KHz position the low frequency roll-off is raised approximately 10:1 to permit faster stabilization when high frequency noise measurements only are required.

6. CALIBRATE Meter and IC CIRCUIT GAIN-DB

The switch and variable concentric control marked IC CIRCUIT GAIN provide the means of setting the overall Model 2283 gain to 10,000. With the TEST-CAL switch in the CAL position the IC CIRCUIT GAIN controls are adjusted to give center scale reading on the CALIBRATE Meter.

7. NEG. VOLTS Meter and Controls and POS. VOLTS Meter and Controls.

The variable bias supplies are controlled and monitored on the front panel. The range switches function as voltmeter multipliers only with the center concentric control knob having the full minimum to maximum voltage control. Note that these supplies are reduced to less than one volt whenever the shield cover on the test fixture is open.

A. GENERAL

The theory of operation of the Model 2283, IC NOISE ANALYZER CONTROL UNIT, can best be followed by referring to the Block Diagram, C-5890, found at the rear of the Manual.

The overall unit including the device under test is set up for a gain of 10,000 through the use of an internal 1 KHz calibrate oscillator and a variable attenuator in the noise channel following the test.

Power supplies are provided for quiescent bias of the test circuit, and upper and lower frequency limits of 100 KHz and 10 Hz respectively are established.

SECTION 4 — CIRCUIT DESCRIPTION

A. GENERAL

The Block Diagram C-5890, shows the basic connections between individual circuits in the Control Unit. Reference to this diagram and appropriate schematic diagrams will aid the reader in following the circuit descriptions.

B. POWER INPUT AND VARIABLE SUPPLIES (Schematic C-5891)

The line connections, power switch and fuses are shown on this schematic. Transformer secondaries are labeled in accordance with their circuit association.

Plug-in Board assembly 5912 contains the rectifiers, capacitors and bleed resistors that make up the unregulated sources for the ± 30V supplies.

Each of the variable supplies has a single integrated circuit which functions as error detector and series regulator driver. These two integrated circuits and other associated components are mounted on plug-in Board assembly 5911.

In the 30V supply, an error existing between the output voltage and the voltage across the reference potentiometer R104, is detected and amplified by IC 101. The output of IC 101 drives series regulator Q101 to minimize the error. Operation of the negative supply is identical with voltage polarities reversed.

C. ± 12V SUPPLIES (Schematic C-5892)

These two bias supplies are identical in circuit description with the exception of the grounding of the output terminals. The following description for the positive supply applies to the negative one as well.

Q201, Q202, Q203 and Q204 make up a double differential error detector and regulator driver. Voltage regulation is obtained by sensing across a standard four element bridge, one element of which is reference diode CR-203. All components for the supply with the exception of the transformer winding and the series regulator transistor, Q205, are mounted on a plug in circuit board.

D. NOISE CHANNEL (Schematic C-5893)

The calibrate oscillator, metering circuit and main noise amplifying channel are shown on this schematic.

Plug-In Board Assembly 5915 contains both the calibrate oscillator and the calibrate meter amplifier. Q302 and Q303 are used as a free running 1KHz multivibrator. The fundamental frequency of the square wave signal is used to standardize the overall gain of the Model 2283. IC 303 and its associated circuitry form a full wave detector which drives the calibrate meter. Bandpass filter, assembly 5900, removes the higher order harmonics at the input of the meter amplifier.

The components required to reduce the variable supply voltages to less than 1 V, when the test fixture shield cover is open, are mounted on Plug-In Board Assembly 5913. When the shield cover is open the interlock switch(S-301) also opens, removing the clamp on Q301. All three reed relays are energized at this time, reducing the power supply voltages and clamping the output of the test circuit to ground.

The main amplifier channel provides selectable gain over the range of from 0 to approximately 50 db. Two amplifier sections, packaged on one plug-in Board assembly 5914 provide the 50 db maximum gain. Channel gain can be reduced to 0 db through the use of the step attenuator (S-303) and a variable gain control (R320) on the second IC amplifier.

A low frequency rolloff characteristic is achieved by C-303, C-304, C-307, C-308 and associated resistors. Assembly 5899 which is a 150 KHz low pass filter, limits the high frequency response of the overall amplifier.

The general purpose behind including the calibrate circuitry and the adjustable gain function is to provide the capability to adjust overall gain including the test circuit to 10,000.

A. GENERAL

1. The Model 2283 Control Unit uses semiconductors throughout with the exception of the shield cover interlock reed relays on Board assembly 5913. Preventive maintenance is not required.

2. It is recommended that the top of the case be removed only if the normal operation checks given below have been performed and the results indicate the necessity of doing so. Servicemen are cautioned not to change calibration adjustments unless it is firmly established that adjustment is required.

3. Main power should be turned off when connecting or disconnecting the printed circuit Board assemblies to avoid damaging semiconductor components through the transient voltages thus created. Care should be taken to insure proper alignment of the printed circuit Board assemblies when replacing them in their sockets.

4. If servicing is required, it is advisable to consult the warranty page for in-warranty servicing information.

B. NORMAL OPERATION

All functions of the Model 2283 can be checked externally without access to the inside of the equipment. To determine if the instrument is operating normally the following procedure may be used.

1. Preliminary Setup

   a. Plug the ten pin extender Board provided into the test board socket located behind the hinged shield cover. Note that the extender board must stay in the horizontal position as physical interference prevents engaging the retaining thumb screws.

   b. Set both the POS VOLTS and NEG VOLTS range switches to the 30 position and both of the concentric control knobs to the full counterclockwise position.

   c. Plug the line cord of the Model 2283 into 117V, 60 Hz line power and turn the power switch to ON. The pilot lamp should be lighted and the three panel meters should remain in the downscale (to the left) position.

2. Positive 30 Volt Variable Power Supply

   a. Connect an external voltmeter between pin 3 of the extender board (pin 1 is on the right when viewed from the front of the equipment) and chassis ground.

   b. Depress the shield cover interlock and adjust the concentric control knob for the positive supply to check meter accuracy, minimum voltage and maximum voltage. The voltage range should be from a few tenths of one volt minimum to at least 30 volts maximum, the meter accuracy should be ± 5% of full scale on both meter ranges.

3. Negative 30 Volt Variable Power Supply

   Follow the same procedure as in 2 above for the negative 30 volt supply which is available on pin 6 of the extender board.

4. ± 12 Volt Fixed Power Supplies

   a. Connect an external voltmeter from pin 8 of the extender board to ground to check the voltage output of the +12V supply. This supply is nominally 12V ± 0.5V.

b. Connect an external voltmeter from pin 9 of the extender board to ground to check the -12V supply. This supply is also nominally 12V ± 0.5V.

c. Note that the fixed supplies are not switched by the shield cover interlock switch.

5. Remote Interlock

a. Apply a short circuit from pin 1 to pin 2 (pin 2 is chassis ground) of the extender board to see that the shield cover interlock function is duplicated (i.e. reduction of the variable power supply voltages for pin 1 - pin 2 open, application of these voltages for pin 1 - pin 2 shorted).

6. Noise Calibrate

a. Place a small shorting jumper between pins 5 and 7 of the extender card socket and close the shield cover. Place the TEST-CAL switch in the CAL position, the IC CIRCUIT GAIN switch in the O DB position and adjust the inner concentric knob for center scale CALIBRATE indication.

b. Apply 0.1 VRMS 1 KHz sine wave to the EXT CAL jack, being certain that the phone plug is inserted completely.

c. The front panel CALIBRATE meter should read on the center CALIBRATE line and the voltage at J302, the NOISE OUT jack, should be 1 V RMS ± 5%.

If the above procedure has been followed and the results indicated obtained, the Model 2283 may be considered to be in normal condition with respect to operating functions and calibration.

C. REMOVAL OF THE COVERS

Either the top or the bottom of the Control Unit may be removed for access to the inside of the equipment. No other screws on the sides or front should be loosened or removed.

D. CHANGING THE INPUT VOLTAGE

This instrument has been designed to operate from either a 117V or 234V AC power source. The plate on the rear of the instrument near the power cord, indicates the voltage and frequency required.

NOTE: When the input voltage on the Model 2283 is changed, the voltage at the rear outlet is also changed, requiring the same voltage change in the companion filter unit. If the input voltage is to be changed, the following procedure should be observed:

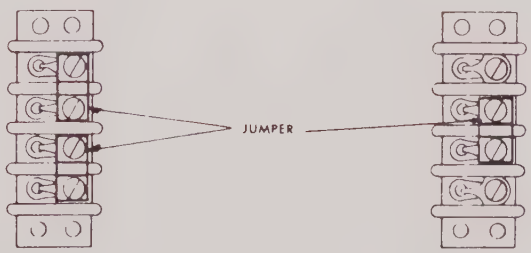
1. Remove the two self tapping screws which hold the voltage plate. If there is a small line voltage switch under the plate, simply change it to read the desired voltage and replace the plate with the proper voltage showing.

2. If there is no switch under the voltage plate, the voltage change must be made inside the equipment.

a. Remove the top cover.

b. Remove the bracket which shields the power connections.

c. Change the transformer primary connections by moving the jumpers on the four terminal barrier strip (see fig. 5-1).



For 117 VAC operation For 234 VAC operation

FIGURE 5 – 1 INPUT VOLTAGE BARRIER STRIP

d. Replace the power connection shield and and the top dust cover.

e. Replace the voltage plate with the correct voltage showing.

E. DETAILED CALIBRATION

1. ± 12V Bias Supplies (Board Assemblies 5909, 5910)

Both of these supplies are set up at the factory for 12V ± 0.5V by installing a selected resistor on the printed circuit board. This resistor is R206 in the positive 12V supply. Further adjustment should not be required on these bias supplies unless a major repair has been performed.

2. Calibrate Meter Amplifier (Board Assembly 5915)

a. Insert the extender board in the test socket and connect a short jumper between pins 5 and 7. (Pin 1 is on the right when viewed from the front of the instrument.)

b. Set the TEST-CAL switch to the CAL position, IC CIRCUIT GAIN switch to the O DB position and close the shield cover.

c. Apply O.1V RMS, 1 KHz to the EXT CAL jack and adjust the variable concentric IC CIRCUIT GAIN control for IV RMS at the NOISE OUT jack, J302.

d. Adjust R337 for mid scale on the CALIBRATE meter

e. Remove the 1 KHz signal from the EXT CAL jack.

3. Calibrate Oscillator (Board Assembly 5915)

a. Adjust R330 for peak reading on the CALIBRATE meter.

b. Adjust R324 for mid scale on the CALIBRATE meter.

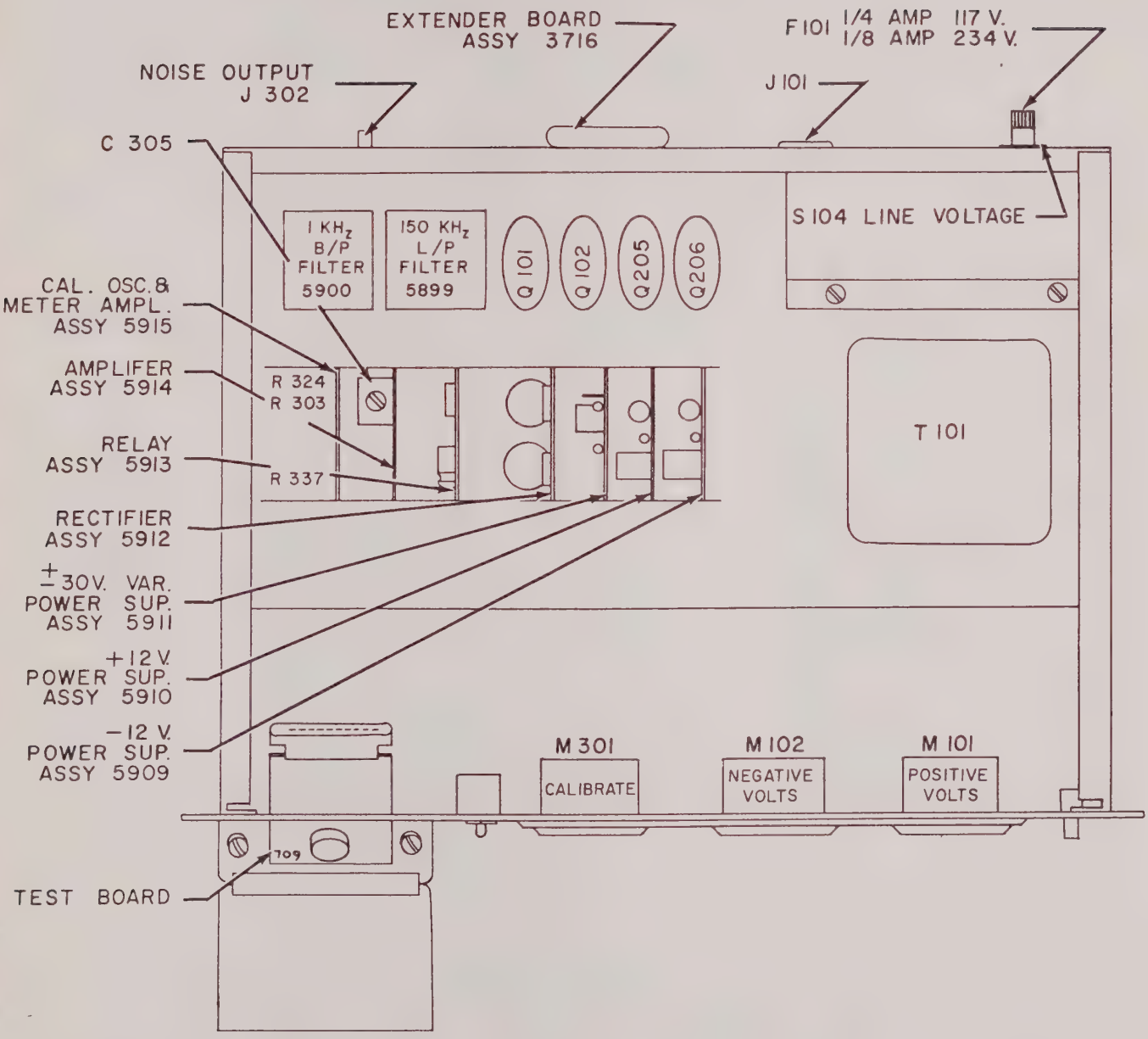


Figure 5–2
Location of Printed Circuit
Board Assemblies

SEMICONDUCTOR LEGEND

Changes and improvements in the semiconductor products available for commercial use necessitate type changes from time to time. To eliminate confusion and costly paperwork, many of these changes will be covered in the following legend. The purpose of this legend is to acknowledge the fact that the type number on a semiconductor found in a piece of equipment will not necessarily correspond with the type number given on the schematic diagram.

The legend is not intended to be an interchangeability list although in many cases good quality components* within a given category may be substituted with acceptable results. Normally, replacements should be made using components having the same type number as the component being replaced.

Those components bearing an asterisk on the schematic diagram are factory selected components and should be obtained from Quan-Tech.

*It should be noted that the incoming inspection procedure followed at Quan-Tech includes noise screening on most semiconductors.

TYPE NO. ON SCHEMATIC	TYPE NO. IN EQUIPMENT
1N482A	1N648, 1N3604, 1N3605
1N703	1N748, 1N749
1N709	1N753
1N2859	1N3253, 1N3254
1N2862	1N3254
1N3253	75A4, 1N3254
1N3254	75A4
1N3604	1N3605, 1N482A, 1N648
1N3605	1N3604, 1N482A, 1N648
TIS73	TIS75
TI480	2N1613, 2N3566, 2N3643 A322, 2N929
TI494	2N1613, 2N3566, 2N3643, A322, 2N929
UC240	2N4869, 2N3819
2N270	2N3644, 2N3250, 2N3251
2N396A	2N414, 4JX1G759, 4JX1D653, 2N3644, 2N3250, 2N3251
2N414	2N396A, 4JX1G759, 4JX1D653, 2N3644, 2N3250, 2N3251
2N929	A322, A324, A642, 220N2, 2N3566, 2N3643, 2N2219

TYPE NO. ON SCHEMATIC	TYPE NO. IN EQUIPMENT
2N1304	2N1306, 2N3566, 2N3643, A322
2N1306	2N1304, 2N3566, 2N3643, A322
2N1515	2N3644, 2N3250, 2N3251
2N1613	2N3566, 2N3643, A322, 2N2219
2N2219	D16C33, 220N2, A322, A324, A642, 2N3566, 2N3643
2N2603	2N3250, 2N3251
2N3250	2N3251, 2N3644
2N3251	2N3250, 2N3644
2N3566	2N3643, A322, 2N929, 2N2219
2N3643	2N3566, 2N2219, A322, 2N929
2N3644	2N3250, 2N3251
2N3819	TIS73, TIS75, TIS59, 2N4869, UC240,
2N4869	2N3819, UC240

SCHEMATIC LEGEND

k – 1000

– Screw Driver Adjustment

– Front Panel Control

* – Factory Select

Unless Otherwise Specified:

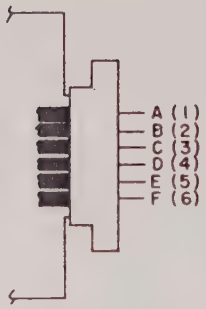
All Resistances in Ohms

All Resistors 1/2 Watt

All Capacitances in Microfarads

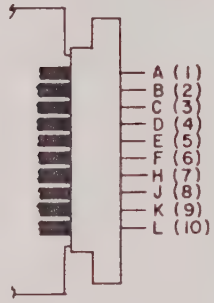
5/21/71

VIEW SHOWING COPPER SIDE OF BOARD



6 PIN

VIEW SHOWING COPPER SIDE OF BOARD



10 PIN

VIEW SHOWING COPPER SIDE OF BOARD

15 PIN

VIEW SHOWING COPPER SIDE OF BOARD

22 PIN

PRINTED CIRCUIT BOARD CONNECTOR LUG IDENTIFICATION

SCHEMATIC LEGEND

k = 1000

⊘ = Screw Driver Adjustment

▭ = Front Panel Control

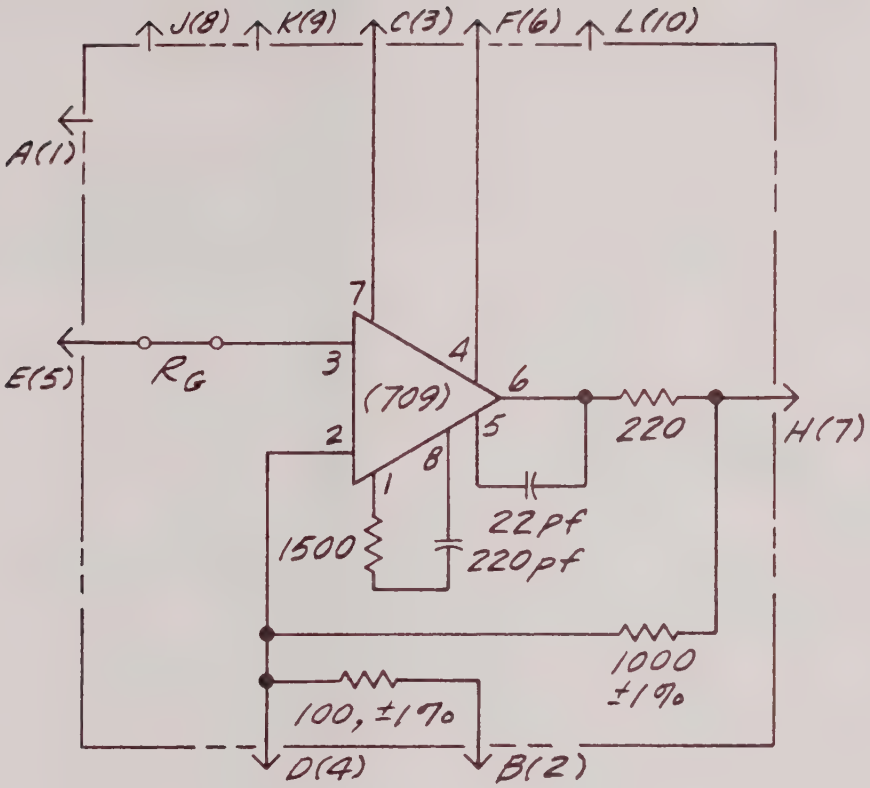
* = Factory Select

Unless Otherwise Specified:

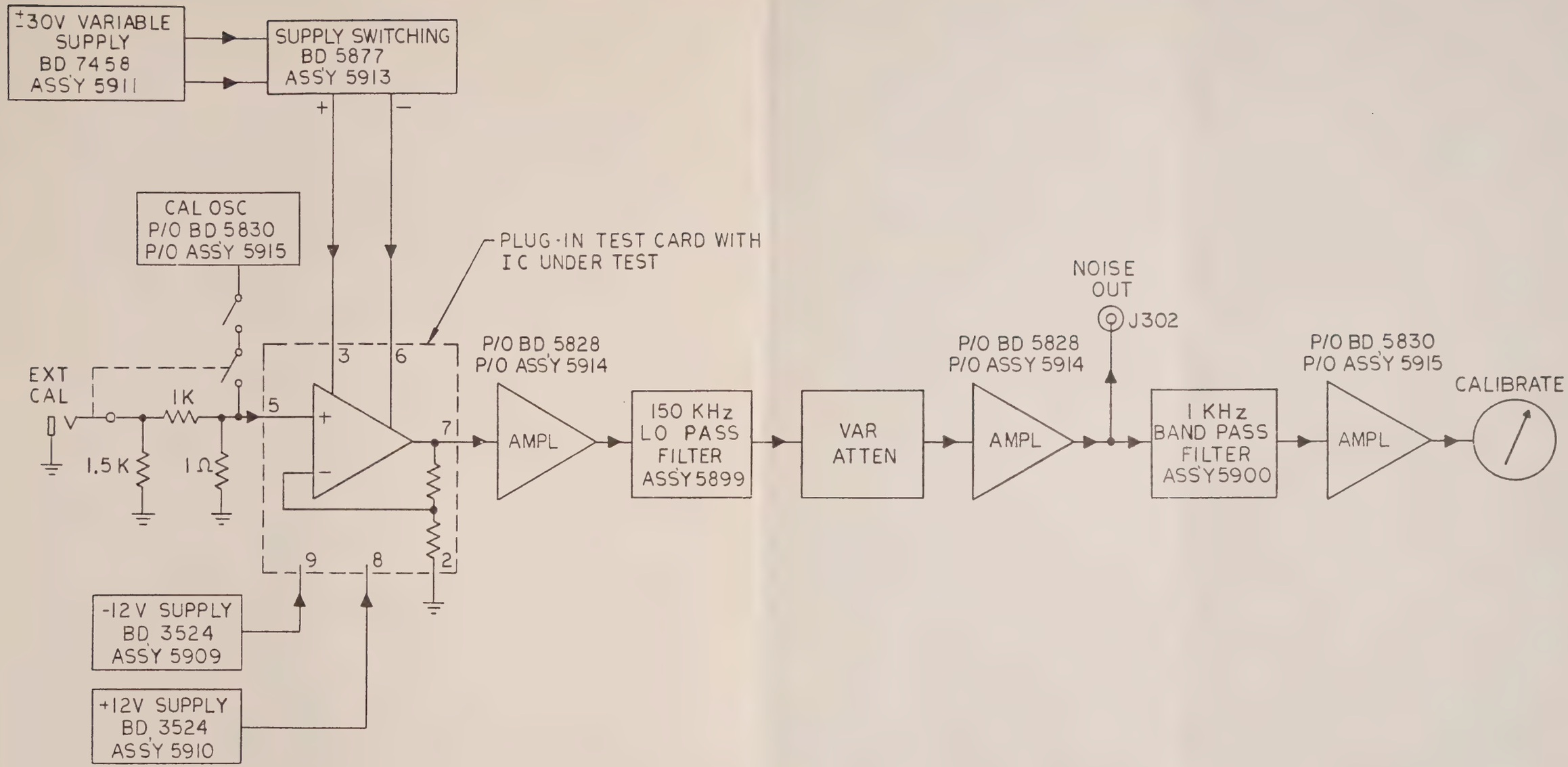
All Resistances in Ohms

All Resistors 1/2 Watt

All Capacitances in Microfarads

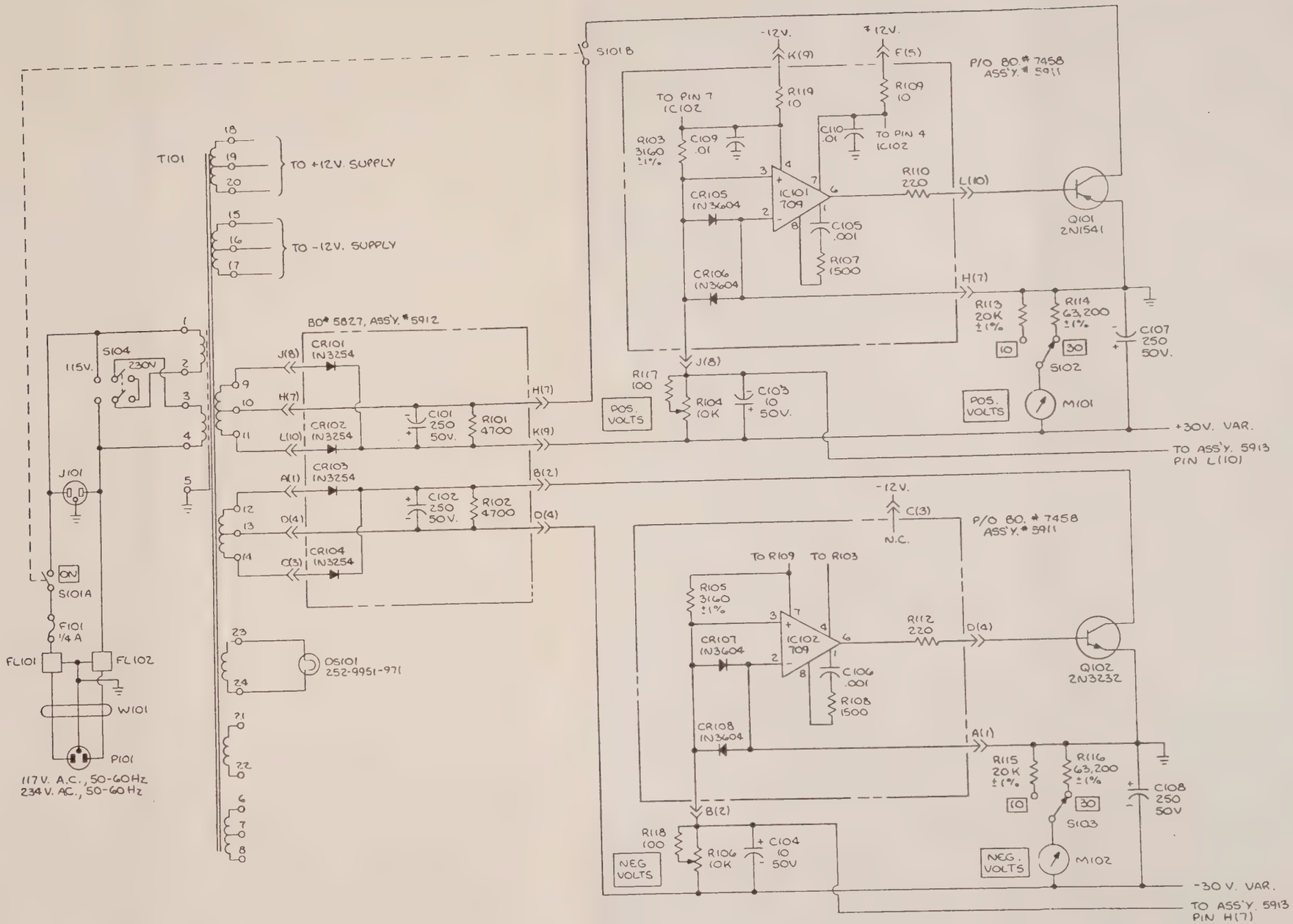


SCHEMATIC A-5919-B
BOARD ASSEMBLY, I.C. TEST (709)
BOARD NO. 5849, ASSEMBLY NO. 5918



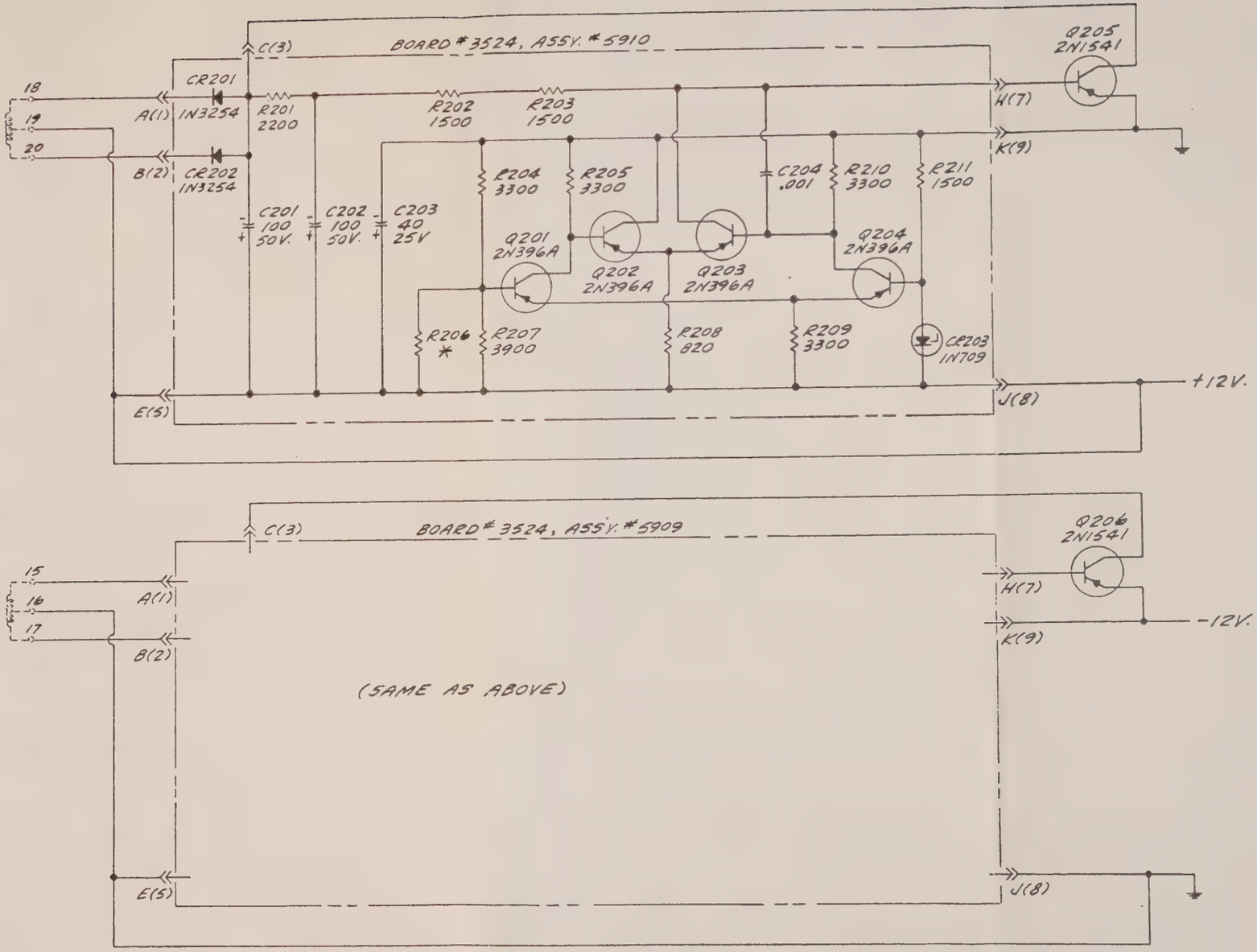
BLOCK DIAGRAM
MODEL 2283

B-5890 -B



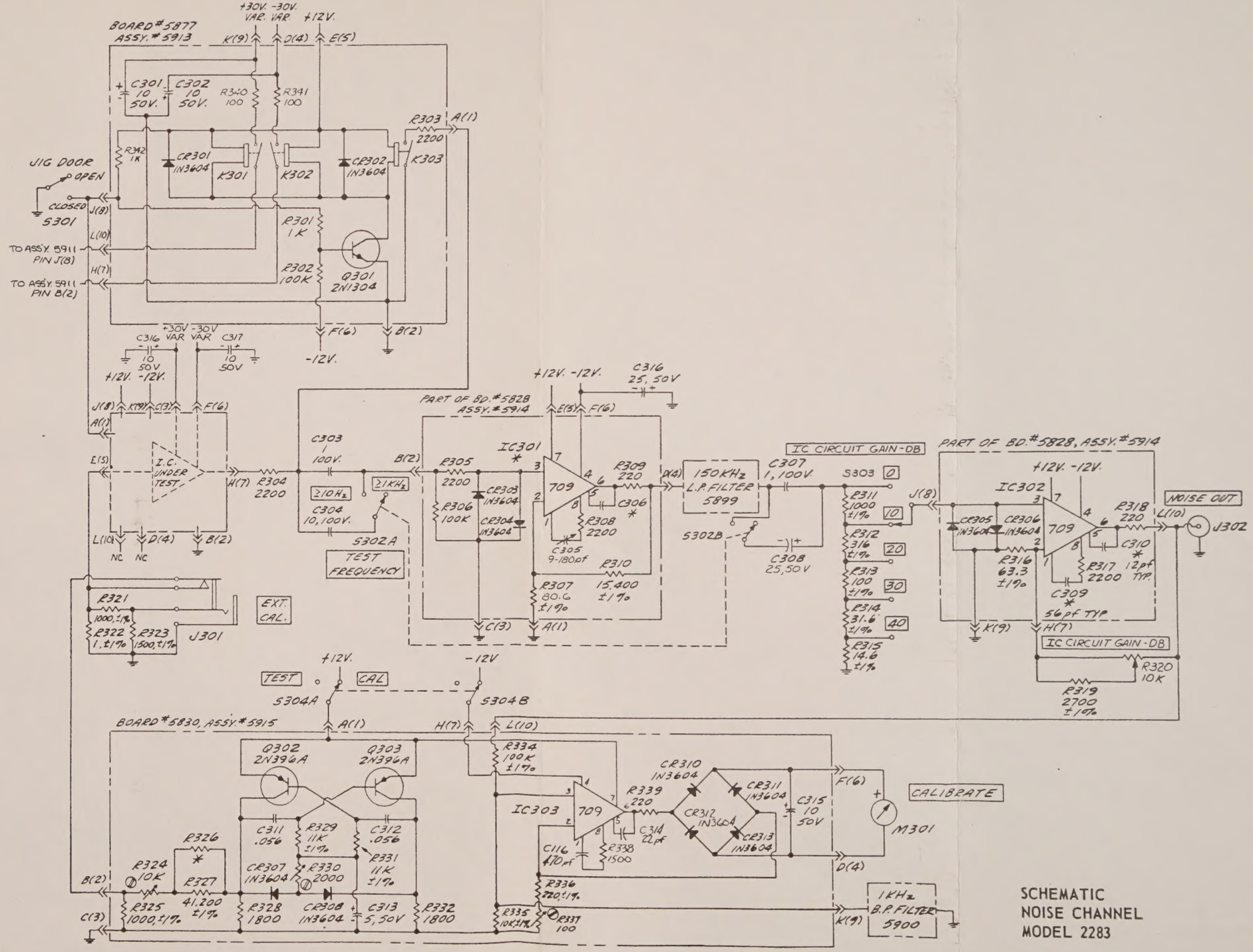
SCHEMATIC
POWER INPUT AND VARIABLE SUPPLIES
MODEL 2283

C-5891-F



SCHEMATIC
12 V. SUPPLIES
MODEL 2283

C-5892-B



SCHEMATIC
NOISE CHANNEL
MODEL 2283

C-5893-G